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10/728,803	12/08/2003	Kia Silverbrook	MTB12US	8900

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BALMAIN, 2041
AUSTRALIA

EXAMINER	
MRUK, GEOFFREY S	
ART UNIT	**PAPER NUMBER**
2853	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/728,803	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Geoffrey Mruk	2853	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 November 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8,10-27 and 29-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,10-27 and 29-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/5/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1-3, 5-7, 11-13, 15, 18-21, 23-26, 30-32, 34, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US 5,706,041) in view of Moon et al. (US 2002/0054191 A1).

With respect to claim 1, Kubby discloses an ink jet printhead (Column 1, line 10) comprising:

- a plurality of nozzles (Column 1, line 10);
- a heater (Fig. 1, element 20) associated with each of the nozzles respectively, the heater having a heater element and two pairs of electrodes (Fig. 1, element 24; Column 3, lines 61-64, Column 4, lines 40-43, i.e. conductive traces),
- the heater element configured for thermal contact with a bubble forming liquid (Column 3, lines 64-67; Column 4, lines 1-4) and
- the electrodes configured for connection to an electrical power source (Column 1, line 20, i.e. digital signal); such that, heating the heater element above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection a drop of ejectable liquid from the nozzle (Column 1, lines 17-30);

- wherein the heater is formed by layers of material (Column 3, lines 64-67; Column 4, lines 1-4), such that the heater element and electrodes are formed of a material (Column 3, line 50 – Column 4, line 22), the two pairs of electrodes overlaying one another (Column 3, lines 53-55) with one of the pairs of electrodes (Fig. 4, element Ta) being connected to the heater element the heater element (Fig. 4, element 20a or 20b, i.e. specific doped regions).

With respect to claim 2, Kubby discloses the layers of heater material (Fig. 2, elements 20 and 22) forming the element and the electrodes (Fig. 1, element 24) are spaced apart (Column 3, lines 61-64).

With respect to claim 3, Kubby discloses the element (Fig. 1, element 18) has two layers of heater material (Fig. 2, elements 20 and 22) and the electrodes have three layers (Fig.1, element 24, Column 3, lines 54, 61-64) of heater material.

With respect to claim 5, Kubby discloses the bubble forming liquid and the ejectable liquid are of a common body of liquid (Column 1, lines 17-30).

With respect to claim 6, Kubby discloses a page-width printhead (Column 14-16).

With respect to claim 7, Kubby discloses each heater element is in the form of a cantilever beam (Column 1, line 66-67, i.e. suspending the heater chips).

With respect to claim 11, Kubby discloses each heater element has two opposite sides and is configured such that a said gas bubble formed by that heater element is formed at both of said sides of that heater element (Column 1, lines 64-67; Column 2, lines 1-16; Column 4, lines 56-66).

With respect to claim 12, Kubby discloses the bubble which each element is configured to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (Column 1, line 27, i.e. nucleation).

With respect to claim 13, Kubby discloses a structure that is formed by chemical vapor deposition (CVD), the nozzles being incorporated on the structure (Column 3, lines 31-35; Column 5, lines 41-49, i.e. conventional CMOS processing).

With respect to claim 15, Kubby discloses a plurality of nozzle chambers each corresponding to a respective nozzle, and a plurality of said heater elements being disposed within each chamber, the heater elements within each chamber being formed on different respective layers (Fig. 1, elements 20 and 24) to one another (Column 1, lines 17-30).

With respect to claim 18, Kubby discloses each heater element is substantially covered by a conformal protective coating (Fig. 3, element Si_3N_4), the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (Column 4, lines 38-43).

With respect to claim 19, Kubby discloses a printer system (Column 1, line 6), which incorporates a printhead (Column 1, line 5), the printhead comprising:

- a plurality of nozzles (Column 1, line 10);
- a heater (Fig. 1, element 20) associated with each of the nozzles respectively, the heater having a heater element and two pairs of electrodes (Fig. 1, element 24; Column 3, lines 61-64, Column 4, lines 40-43, i.e. conductive traces),

- the heater element configured for thermal contact with a bubble forming liquid (Column 3, lines 64-67; Column 4, lines 1-4) and
- the electrodes configured for connection to an electrical power source (Column 1, line 20, i.e. digital signal); such that, heating the heater element above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection a drop of ejectable liquid from the nozzle (Column 1, lines 17-30);
- wherein the heater is formed by layers of material (Column 3, lines 64-67; Column 4, lines 1-4), such that the heater element and electrodes are formed of a material (Column 3, line 50 – Column 4, line 22), the two pairs of electrodes overlaying one another (Column 3, lines 53-55) with one of the pairs of electrodes (Fig. 4, element Ta) being connected to the heater element the heater element (Fig. 4, element 20a or 20b, i.e. specific doped regions).

With respect to claim 20, Kubby discloses the layers of heater material (Fig. 2, elements 20 and 22) forming the element and the electrodes (Fig. 1, element 24) are spaced apart (Column 3, lines 61-64).

With respect to claim 21, Kubby discloses the element (Fig. 1, element 18) has two layers of heater material (Fig. 2, elements 20 and 22) and the electrodes have three layers (Fig.1, element 24, Column 3, lines 54, 61-64) of heater material.

With respect to claim 23, Kubby discloses the bubble forming liquid in thermal contact with each said heater element, and to support the ejectable liquid adjacent each nozzle (Column 4, lines 56-66).

With respect to claim 24, Kubby discloses the bubble forming liquid and the ejectable liquid are of a common body of liquid (Column 1, lines 17-30).

With respect to claim 25, Kubby discloses a page-width printhead (Column 14-16).

With respect to claim 26, Kubby discloses each heater element is in the form of a cantilever beam (Column 1, line 66-67, i.e. suspending the heater chips).

With respect to claim 30, Kubby discloses each heater element has two opposite sides and is configured such that a said gas bubble formed by that heater element is formed at both of said sides of that heater element (Column 1, lines 64-67; Column 2, lines 1-16; Column 4, lines 56-66).

With respect to claim 31, Kubby discloses the bubble which each element is configured to form is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse of a bubble formed thereby is spaced from that heater element (Column 1, line 27, i.e. nucleation).

With respect to claim 32, Kubby discloses a structure that is formed by chemical vapor deposition (CVD), the nozzles being incorporated on the structure (Column 3, lines 31-35; Column 5, lines 41-49, i.e. conventional CMOS processing).

With respect to claim 34, Kubby discloses a plurality of nozzle chambers each corresponding to a respective nozzle, and a plurality of said heater elements being disposed within each chamber, the heater elements within each chamber being formed on different respective layers (Fig. 1, elements 20 and 24) to one another (Column 1, lines 17-30).

With respect to claim 37, Kubby discloses each heater element is substantially covered by a conformal protective coating (Fig. 3, element Si_3N_4), the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (Column 4, lines 38-43).

However, Kubby fails to disclose the heater element and electrodes are formed of the same material.

Moon discloses an ink jet printer head where "a heater portion 221 and the electrode portions 222 are typically made of a single material or of a same material" (paragraph 0036).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the heater and electrode portions disclosed by Moon in the printhead of Kubby. The motivation for doing so would have been "the process and cost of fabrication of an ink jet printer head according to the present invention can be reduced, and productivity can thereby be increased" (paragraph 0036).

2. Claims 4, 16, 17, 22, 35, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US 5,706,041) in view of Moon et al. (US 2002/0054191 A1) as applied to claims 1 and 19 above, and further in view of The Fabrication and Reliability Testing of Ti/TiN Heaters (DeMoor).

Kubby disclosed the claimed inventions with the exception of:

- the heater material is titanium nitride,

- each heater element is formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50, and
- each heater element includes solid material and is configured for a mass of less than 10 nanograms of the solid material of that heater element to be heated to a temperature above said boiling point thereby to heat said part of the bubble forming liquid to a temperature above said boiling point to cause the ejection of a said drop.

DeMoor discloses:

- it is desirable to use a heater made of Ti/TiN in integrated MEMS systems (a thermal inkjet is such a system), because this material provides the advantages of CMOS fabrication (low cost and uniformity) in combination with a very high reliability (see conclusion),
- Ti has an atomic number of 22, and
- Each heater element includes solid material and is configured for a mass of less than 10 nanograms (Table 1 and Fabrication dimensions).

At the time the invention, it would have been obvious to one of ordinary skill in the art to use the Ti/TiN Heaters of DeMoor in the ink-jet printhead of Kubby. The motivation for doing so would have been to provide the advantages of CMOS fabrication (low cost and uniformity) in combination with a very high reliability Ti/TiN heater (Conclusion).

3. Claims 8 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US 5,706,041) in view of Moon et al. (US 2002/0054191 A1) as applied to claims 1 and 19 above, and further in view of Silverbrook (US 5,841,452).

Kubby disclosed the claimed inventions with the exception of each heater element is configured such that an actuation energy of less than 500 nanojoules (nJ) is required to be applied to that heater element to heat that heater element sufficiently to form a said bubble in the bubble forming liquid thereby to cause the ejection of a said drop.

Silverbrook discloses a thermal ink jet printer, which uses heater energy of 200 nJ to eject ink. Using this energy allows the power dissipation to be reduced without affecting print speed (Column 18, lines 15-18).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of Silverbrook in the ink-jet printhead of Kubby. The motivation for doing so would have been to reduce power dissipation without affecting print speed (Column 18, lines 15-18).

4. Claims 10 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US 5,706,041) in view of Moon et al. (US 2002/0054191 A1) as applied to claims 1 and 19 above, and further in view of in view of Feinn et al. (US 6,543,879 B1).

Kubby disclosed the claimed inventions with the exception of area density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square cm of substrate surface.

Feinn discloses an ink jet print head having a nozzle density of at least 10,000 nozzles per square cm (see Abstract) in order to improve the resolution of the print head (Column 1, lines 53-67).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of Feinn in the ink-jet printhead of Kubby. The motivation for doing so would have been to improve the drop generation rate of the print head (Column 1, lines 53-61).

5. Claims 14 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US 5,706,041) in view of Moon et al. (US 2002/0054191 A1) as applied to claims 1 and 19 above, and further in view of Kashino et al. (US 5,534,898).
Kubby disclosed the claimed inventions with the exception of a structure, which is less than 10 microns thick, the nozzles being incorporated on the structure.
Kashino discloses that it is desirable to have a nozzle plate that is only several microns thick, in order to obtain adequate values of drop velocity, drop size and refilling frequency (Column 6, lines 34-42).

At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the teachings of Kashino in the ink-jet printhead of Kubby. The motivation for doing so would have been to obtain adequate values of drop velocity, drop size and refilling frequency (Column 6, lines 34-42).

Response to Arguments

Applicant's arguments filed 11 November 2007 have been fully considered but they are not persuasive. The applicant argues "none of these cited references teach or suggest provided two pairs of electrodes, with only one of tile pairs being connected to a heater element." However, Kubby discloses a thermal inkjet printhead having a suspended heating element where "Suspended portion 18 may be supported over cavity 16 by any number of "legs" 19 formed in functional layer 14. There is disposed within suspended portion 18 any number of specially doped regions, such as 20 or 22, which are preferably formed within at least one polysilicon layer within functional layer 14. As is known in the art, various semiconductor devices, such as resistors, can be obtained by doping specific areas in a polysilicon layer to particular resistivities. There is also shown, connecting to doped regions such as 20 and 22 any number of conductors, typically made of aluminum, such as 24, disposed over the legs 19" (Column 3, lines 53-64). Therefore, Kubby in view of Moon meet the claimed limitations.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Geoffrey Mruk whose telephone number is (571) 272-2810. The examiner can normally be reached on Monday-Friday 7:30am - 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

GSM
1/10/2008

GM

STEPHEN MEIER
SUPERVISORY PATENT EXAMINER